

## WHAT IS CLAIMED IS:

1. A wide-area high-resolution image generation method comprising the steps of:

a total image acquisition step in which a target object of the generation of a wide-area high-resolution image is captured by a capture device and thereby a total image of the target object is acquired;

an image structure analysis step in which image structure analysis is conducted to the total image of the target object and thereby structural elements are extracted from the total image and position information of each structural element is obtained;

a sub-image acquisition step which is conducted for one or more of the structural elements, in which one or more partial areas and a resolution to be used for capturing the structural element are determined and sub-images of the partial areas of the structural element are acquired by the capture device with the determined resolution;

an image connection step which is conducted for each of the structural elements to which the sub-image acquisition step has been conducted, in which the sub-images of the partial areas of the structural element are connected together by use of image information of the sub-images and thereby an image of the structural element having the determined resolution is obtained as a synthesis target image;

an image extraction step which is conducted for each of the structural elements to which the sub-image acquisition step has not been conducted, in which part of the total image corresponding to the structural element is extracted from the total image as a synthesis target image; and

a wide-area high-resolution image generation step in which the synthesis target images of the structural elements obtained in the image connection steps and the image extraction steps are synthesized so that relative position relationship of the synthesis target images will be the

30 same as that of the structural elements in the total image of the target object based on the position information of the structural elements obtained in the image structure analysis step and thereby a wide-area high-resolution image of the target object is obtained.

2. A wide-area high-resolution image generation method as claimed in claim 1, wherein the wide-area high-resolution image generation method further comprises an attribute determination step in which the attribute of each structural element is determined based on  
5 the image structure analysis, and

the sub-image acquisition step is conducted for structural elements having attributes that require higher resolution than that of the total image.

3. A wide-area high-resolution image generation method as claimed in claim 2, wherein:

the wide-area high-resolution image generation method further comprises a resolution judgment step which is conducted for each of the  
5 structural elements to which the sub-image acquisition step has been conducted, in which whether or not a sufficient resolution predetermined for the attribute of the structural element could be attained is judged, and

the sub-image acquisition step is repeated with a higher  
10 resolution and new partial areas for each of the structural elements that have been judged to have insufficient resolution in the resolution judgment step, until the sufficient resolution predetermined for the attribute is attained, and

the image connection step for the structural element is conducted  
15 by use of the sub-images which attained the sufficient resolution.

4. A wide-area high-resolution image generation method as claimed in claim 3, wherein in the resolution judgment step, one or more fine structural elements are extracted from the sub-images of the structural element and the judgment on the resolution is executed based  
5 on pixel density of the extracted fine structural elements.

5. A wide-area high-resolution image generation method as claimed in claim 4, wherein one or more letters are extracted as the fine structural elements in the resolution judgment step.

6. A wide-area high-resolution image generation method as claimed in claim 1, further comprising:

a geometrical deformation estimation step in which geometrical deformation is estimated between every two adjoining sub-images of a  
5 structural element and thereby geometrical deformation of each sub-image of the structural element is estimated; and

a geometrical deformation compensation step in which the geometrical deformation of each sub-image of the structural element is compensated for based on the geometrical deformation estimated in the  
10 geometrical deformation estimation step and thereby deformation-compensated sub-images of the structural element are obtained to be used in the image connection step.

7. A wide-area high-resolution image generation method as claimed in claim 6, wherein in the geometrical deformation estimation step, the estimation of the geometrical deformation between two adjoining sub-images is conducted using one or more fine structural  
5 elements extracted from the two adjoining sub-images.

8. A wide-area high-resolution image generation method as

claimed in claim 7, wherein in the geometrical deformation estimation step, one or more letters extracted from the two adjoining sub-images are used as the fine structural elements.

9. A wide-area high-resolution image generation method as claimed in claim 7, wherein in the geometrical deformation estimation step, the estimation of the geometrical deformation between the two adjoining sub-images is conducted by estimating geometrical  
5 deformation of each of one or more fine structural elements between the two adjoining sub-images individually and taking the average of the geometrical deformations of the fine structural elements.

10. A wide-area high-resolution image generation method as claimed in claim 4, wherein:

the wide-area high-resolution image generation method further comprises:

5 a geometrical deformation estimation step in which geometrical deformation is estimated between every two adjoining sub-images of a structural element and thereby geometrical deformation of each sub-image of the structural element is estimated; and

10 a geometrical deformation compensation step in which the geometrical deformation of each sub-image of the structural element is compensated for based on the geometrical deformation estimated in the geometrical deformation estimation step and thereby deformation-compensated sub-images of the structural element are obtained to be used in the image connection step, and

15 in the geometrical deformation estimation step, the estimation of the geometrical deformation between two adjoining sub-images is conducted using the fine structural elements extracted in the resolution judgment step.

11. A wide-area high-resolution image generation system comprising a processing device which is connected to a capture device whose capturing direction and zoom ratio are controllable, wherein the processing device includes:

5 a total image acquisition means for capturing a target object of the generation of a wide-area high-resolution image by use of the capture device and thereby acquiring a total image of the target object;

an image structure analysis means for conducting image structure analysis to the total image of the target object and thereby extracting  
10 structural elements from the total image and obtaining position information of each structural element;

a sub-image acquisition means which conducts a sub-image acquisition process for one or more of the structural elements, in which one or more partial areas and a resolution to be used for capturing the  
15 structural element are determined and sub-images of the partial areas of the structural element are acquired by the capture device with the determined resolution;

an image connection means which conducts an image connection process for each of the structural elements to which the sub-image  
20 acquisition process has been conducted, in which the sub-images of the partial areas of the structural element are connected together by use of image information of the sub-images and thereby an image of the structural element having the determined resolution is obtained as a synthesis target image;

25 an image extraction means which conducts an image extraction process for each of the structural elements to which the sub-image acquisition process has not been conducted, in which part of the total image corresponding to the structural element is extracted from the total image as a synthesis target image; and

30           a wide-area high-resolution image generation means for  
synthesizing the synthesis target images of the structural elements  
obtained in the image connection process and the image extraction  
process so that relative position relationship of the synthesis target  
images will be the same as that of the structural elements in the total  
35 image of the target object based on the position information of the  
structural elements obtained by the image structure analysis means and  
thereby obtaining a wide-area high-resolution image of the target object.

12. A wide-area high-resolution image generation system as  
claimed in claim 11, wherein:

the processing device further includes an attribute determination  
means for determining the attribute of each structural element based on  
5 the image structure analysis conducted by the image structure analysis  
means, and

the sub-image acquisition means conducts the sub-image  
acquisition process for structural elements having attributes that require  
higher resolution than that of the total image.

13. A wide-area high-resolution image generation system as  
claimed in claim 12, wherein:

the processing device further includes a resolution judgment  
means which conducts a resolution judgment process for each of the  
5 structural elements to which the sub-image acquisition process has been  
conducted, in which whether or not a sufficient resolution predetermined  
for the attribute of the structural element could be attained is judged,  
and

the sub-image acquisition means repeats the sub-image  
10 acquisition process with a higher resolution and new partial areas for  
each of the structural elements that have been judged to have

insufficient resolution in the resolution judgment process, until the sufficient resolution predetermined for the attribute is attained, and

the image connection means conducts the image connection  
15 process for the structural element by use of the sub-images which  
attained the sufficient resolution.

14. A wide-area high-resolution image generation system as  
claimed in claim 13, wherein the resolution judgment means extracts one  
or more fine structural elements from the sub-images of the structural  
element and executes the judgment on the resolution based on pixel  
5 density of the extracted fine structural elements.

15. A wide-area high-resolution image generation system as  
claimed in claim 14, wherein the resolution judgment means extracts one  
or more letters as the fine structural elements.

16. A wide-area high-resolution image generation system as  
claimed in claim 11, wherein the processing device further includes:

a geometrical deformation estimation means for estimating  
geometrical deformation between every two adjoining sub-images of a  
5 structural element and thereby estimating geometrical deformation of  
each sub-image of the structural element; and

a geometrical deformation compensation means for compensating  
for the geometrical deformation of each sub-image of the structural  
element based on the geometrical deformation estimated by the  
10 geometrical deformation estimation means and thereby obtaining  
deformation-compensated sub-images of the structural element to be  
used in the image connection process.

17. A wide-area high-resolution image generation system as

claimed in claim 16, wherein the geometrical deformation estimation means conducts the estimation of the geometrical deformation between two adjoining sub-images using one or more fine structural elements  
5 extracted from the two adjoining sub-images.

18. A wide-area high-resolution image generation system as claimed in claim 17, wherein the geometrical deformation estimation means uses one or more letters extracted from the two adjoining sub-images as the fine structural elements.

19. A wide-area high-resolution image generation system as claimed in claim 17, wherein the geometrical deformation estimation means conducts the estimation of the geometrical deformation between the two adjoining sub-images by estimating geometrical deformation of  
5 each of one or more fine structural elements between the two adjoining sub-images individually and taking the average of the geometrical deformations of the fine structural elements.

20. A wide-area high-resolution image generation system as claimed in claim 14, wherein:

the processing device further includes:

a geometrical deformation estimation means for estimating  
5 geometrical deformation between every two adjoining sub-images of a structural element and thereby estimating geometrical deformation of each sub-image of the structural element; and

a geometrical deformation compensation means for compensating for the geometrical deformation of each sub-image of the structural  
10 element based on the geometrical deformation estimated by the geometrical deformation estimation means and thereby obtaining deformation-compensated sub-images of the structural element to be

used in the image connection process, and

the geometrical deformation estimation means conducts the  
15 estimation of the geometrical deformation between two adjoining  
sub-images using the fine structural elements extracted by the resolution  
judgment means.

21. A machine-readable record medium storing a program for  
instructing a computer, a DSP (Digital Signal Processor), etc. to execute  
a wide-area high-resolution image generation process, wherein the  
wide-area high-resolution image generation process comprises the steps  
5 of:

a total image acquisition step in which a target object of the  
generation of a wide-area high-resolution image is captured by a capture  
device and thereby a total image of the target object is acquired;

an image structure analysis step in which image structure  
10 analysis is conducted to the total image of the target object and thereby  
structural elements are extracted from the total image and position  
information of each structural element is obtained;

a sub-image acquisition step which is conducted for one or more of  
the structural elements, in which one or more partial areas and a  
15 resolution to be used for capturing the structural element are  
determined and sub-images of the partial areas of the structural element  
are acquired by the capture device with the determined resolution;

an image connection step which is conducted for each of the  
structural elements to which the sub-image acquisition step has been  
20 conducted, in which the sub-images of the partial areas of the structural  
element are connected together by use of image information of the  
sub-images and thereby an image of the structural element having the  
determined resolution is obtained as a synthesis target image;

an image extraction step which is conducted for each of the

25 structural elements to which the sub-image acquisition step has not been  
conducted, in which part of the total image corresponding to the  
structural element is extracted from the total image as a synthesis target  
image; and

30 a wide-area high-resolution image generation step in which the  
synthesis target images of the structural elements obtained in the image  
connection steps and the image extraction steps are synthesized so that  
relative position relationship of the synthesis target images will be the  
same as that of the structural elements in the total image of the target  
object based on the position information of the structural elements  
35 obtained in the image structure analysis step and thereby a wide-area  
high-resolution image of the target object is obtained.

22. A machine-readable record medium as claimed in claim 21,  
wherein the wide-area high-resolution image generation process further  
comprises an attribute determination step in which the attribute of each  
structural element is determined based on the image structure analysis,  
5 and

the sub-image acquisition step is conducted for structural  
elements having attributes that require higher resolution than that of  
the total image.

23. A machine-readable record medium as claimed in claim 22,  
wherein:

the wide-area high-resolution image generation process further  
comprises a resolution judgment step which is conducted for each of the  
5 structural elements to which the sub-image acquisition step has been  
conducted, in which whether or not a sufficient resolution predetermined  
for the attribute of the structural element could be attained is judged,  
and

the sub-image acquisition step is repeated with a higher  
10 resolution and new partial areas for each of the structural elements that  
have been judged to have insufficient resolution in the resolution  
judgment step, until the sufficient resolution predetermined for the  
attribute is attained, and

the image connection step for the structural element is conducted  
15 by use of the sub-images which attained the sufficient resolution.

24. A machine-readable record medium as claimed in claim 23,  
wherein in the resolution judgment step, one or more fine structural  
elements are extracted from the sub-images of the structural element  
and the judgment on the resolution is executed based on pixel density of  
5 the extracted fine structural elements.

25. A machine-readable record medium as claimed in claim 24,  
wherein one or more letters are extracted as the fine structural elements  
in the resolution judgment step.

26. A machine-readable record medium as claimed in claim 21,  
wherein the wide-area high-resolution image generation process further  
comprises:

a geometrical deformation estimation step in which geometrical  
5 deformation is estimated between every two adjoining sub-images of a  
structural element and thereby geometrical deformation of each  
sub-image of the structural element is estimated; and

a geometrical deformation compensation step in which the  
geometrical deformation of each sub-image of the structural element is  
10 compensated for based on the geometrical deformation estimated in the  
geometrical deformation estimation step and thereby  
deformation-compensated sub-images of the structural element are

obtained to be used in the image connection step.

27. A machine-readable record medium as claimed in claim 26, wherein in the geometrical deformation estimation step, the estimation of the geometrical deformation between two adjoining sub-images is conducted using one or more fine structural elements extracted from the  
5 two adjoining sub-images.

28. A machine-readable record medium as claimed in claim 27, wherein in the geometrical deformation estimation step, one or more letters extracted from the two adjoining sub-images are used as the fine structural elements.

29. A machine-readable record medium as claimed in claim 27, wherein in the geometrical deformation estimation step, the estimation of the geometrical deformation between the two adjoining sub-images is conducted by estimating geometrical deformation of each of one or more  
5 fine structural elements between the two adjoining sub-images individually and taking the average of the geometrical deformations of the fine structural elements.

30. A machine-readable record medium as claimed in claim 24, wherein:

the wide-area high-resolution image generation process further comprises:

5 a geometrical deformation estimation step in which geometrical deformation is estimated between every two adjoining sub-images of a structural element and thereby geometrical deformation of each sub-image of the structural element is estimated; and

a geometrical deformation compensation step in which the

- 10 geometrical deformation of each sub-image of the structural element is compensated for based on the geometrical deformation estimated in the geometrical deformation estimation step and thereby deformation-compensated sub-images of the structural element are obtained to be used in the image connection step, and
- 15 in the geometrical deformation estimation step, the estimation of the geometrical deformation between two adjoining sub-images is conducted using the fine structural elements extracted in the resolution judgment step.